SPRAY DRYER

Special Notes

1. Products will burn if the outlet temperature is too high. Start with an outlet T of 85° C.

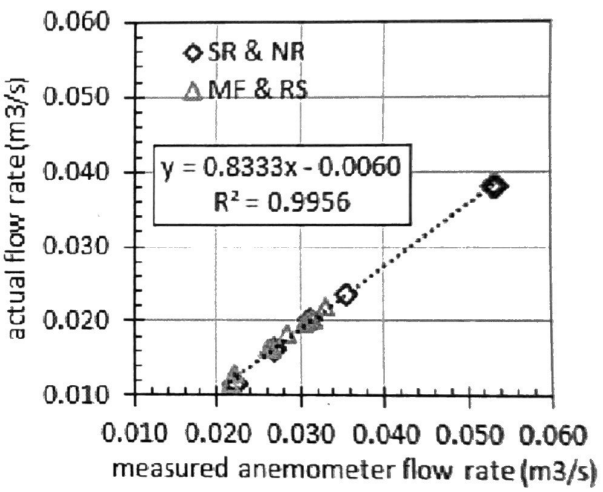
2. The atomizer is very delicate. When it is removed from the dryer, it should be placed in the wooden case. Never set the atomizer unit on a table top resting on the spindle.

3. The atomizer wheel should be removed for cleaning after each use. Use the special wrench and spacer. Do not overtighten on spindle. Use care not to bend the spindle.

4. Always check that all ducts and the sample bottle are in place before starting the heater. Keep the butterfly valve at the control panel fully open. Have a plastic beaker filled with RO water always available at the pump for both startup and for quick cooling in case of need. It is possible to severely overheat the unit and melt wiring.

5. The anemometer needs to be firmly held against the 4" diameter tube to obtain valid data. If the relative humidity at the wall exhaust pipe measures 99.9% after several minutes of sampling, use the metal extension tube instead of the wall exit point for the exhaust measurements.

   The anemometer readings were calibrated using a pitot tube. The figure on the right shows the calibration curve for the readings. You will need to make corrections to obtain valid data.



6. For the prereport calculations, make the following assumptions:

   a. 40% relative humidity, 113 °F, and 2.5 m/s velocity at the 4 in diameter sampling duct on the south wall of the lab;
   b. 300 °F at the inlet of the spray drier (as reported on the control panel);
   c. a 32 °F reference temperature for the Munters psychrometric chart;
   d. the specific enthalpy of the powder milk mixed to make the feed is equal to the specific enthalpy of the powder milk collected in the jar.

7. For the prereport calculations, find the Minimum Explosive Concentration (MEC) for the milk powder and determine the upper limit on the milk powder feed rate to ensure that your operation **never exceeds 15%** of this value.

OHAUS MOISTURE BALANCE

The OHAUS balance is simply a computerized scale with a heating element. This machine weighs a sample of material and uses a heating element to evaporate the water from the sample to find the weight percent water in the sample. The machine can easily be programmed to dry a sample for a given amount of time (normal mode), dry the sample until a specified evaporation rate is reached (auto mode), or dry using multiple temperatures (multi-temp program).

The following program has been developed to test the moisture content in powdered milk.

1. Plug in the balance. The power light should go on.

2. Lift hood if it is down and place an empty, disposable weighing pan on the balance. Press ON TARE to obtain a zero reading.

3. Press either of the arrow keys until the display shows "AUTO DRY MODE." Press the SELECT key. A temperature (C), weight (g), and time (sec) should show on the display.

4. Press the SELECT key to select the heating temperature. Use the arrow keys to select 80°C as the temperature.

5. Press the SELECT key to select the "delta." Use the arrow keys to select 0.01 g for the value.

6. Press the SELECT key to select the time. Use the arrow keys to select 60 seconds. (Note: steps 5 and 6 set the program to terminate when 0.01 g of water or less is evaporated in 60 sec.)

7. Press the SELECT key again to leave the programming mode. Transfer the weighing pan which was tared in step 2 to another balance. Using the <u>other balance</u>, place 10-11 grams of sample on the balance pan. Lift the balance pan off of the scale and spread out the sample. Use the bottom of another pan to pack down the sample. Return the pan sample to the moisture balance.

8. Lower the hood and press the start button. The run light should flash on and off and the actual temperature should start to rise. The cycle should shut itself off automatically.

   CAUTION: Many parts of the machine and the pan inside are hot. Do not disturb the machine during a cycle.

9. A beep will sound when the cycle ends. Raise the hood so the machine can cool. Press either arrow key to access information from the cycle.

10. When the machine cools (about 5 min), remove the pan and wipe clean the balance and hood area. Turn off the balance if you are finished or put on a new sample and press ON TARE to start another sample.

11. Dump the material off the pan and reuse if possible.

NIRO ATOMIZER

PORTABLE SPRAY DRYER

INSTRUCTION MANUAL

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C A U T I O N

WHEN MAKING THE ELECTRICAL HOOKUP, IT IS IMPORTANT THAT THE INTERNAL CONNECTIONS IN THE FAN MOTOR BE CHECKED AGAINST THE WIRING SCHEMATIC (PAGE 11) IN THIS MANUAL TO INSURE THAT THE MOTOR IS WIRED FOR THE PROPER VOLTAGE. ALSO, REFER TO PAGES 9 AND 10 FOR FURTHER INSTRUCTIONS REGARDING THE ELECTRICAL INSTALLATION.

INTRODUCTION

PRINCIPLES INVOLVED

Spray drying in the NIRO ATOMIZER Portable Unit transforms a feed liquid into a dry powder in a continuous one step operation. The drying operation consists of three stages:

(a) Atomization of the feed liquid into a spray by the use of a vaned wheel rotating at high speed.

(b) The contacting of the spray with hot air to promote evaporation. The hot air enters the chamber around the atomizer vaned wheel.

(c) The separation of dried product from the air in a cyclone.

The basic principles involved concern the atomization of the feed liquid into a spray of very small droplets. These droplets have a very large surface area and evaporation is completed rapidly. The necessary small droplet sizes are produced by rotating the vaned wheel at high speeds. The resulting evaporation rates are high enough to enable completion of moisture removal from the droplets, even though the small chamber volume gives short droplet residence times in the dryer. During the evaporation stage, there is an accompanying cooling affect on the droplets, with the product residence time in the chamber of short duration, heat damage of the product is prevented.

BACKGROUND

The Portable unit is a spray dryer sized for laboratory use. It is ideal for spray drying small amounts of feed liquids, solutions, or light slurries. The unit is completely assembled within a sturdy framework. It is built on castors for easy maneuverability. Operation of the unit simply requires:

(a) Connection of the open end of the exhaust air duct with some form of flexible ducting, so that the drying air can be vented to atmosphere.

(b) Making the necessary electrical connections to the main terminal strip.

(c) Connection of the unit to a compressed air supply.

The Portable spray dryer is designed and constructed to handle only small quantities of product. Experience has shown that information obtained on the unit is invaluable for planning the scale-up of the drying process. The spray dryer is simple to operate and control. A test drying run can be quickly set up, and test powder becomes available immediately when test drying is commenced. A window in the chamber wall is provided to view the drying process. Once drying is completed, the interior of the dryer is readily accessible for quick and easy cleaning. All parts in contact with the product are fabricated in stainless steel AISI 316. The product is collected in glass jars. The dryer layout enables optimum hygienic conditions to be maintained at all times.

GENERAL INFORMATION

The Portable spray dryer is dispatched from the manufacturer already assembled. It is supplied in a strengthened wooden crate. The two glass jars for the powder collection, and the atomizer are separately packed. The packages are found attached to the interior of the wooden crate. The atomizer is supplied in its own special box, together with the necessary tools for atomizer maintenance.

Care must always be taken when the wooden crate is dismantled and the unit is transferred to its location of use. The most suitable location is an area where electric power and compressed air supplies are on hand. There should also be available, water for washing, and floor drainage. Preferably, the unit should be near an outside building wall, so that a minimum of flexible ducting is required to vent the exhaust drying air to atmosphere. The flexible ducting must be of the heat resistant type, having an internal diameter of 3-3/8 inches (85 mm). Wherever possible, the duct length should not exceed 10 foot (3 meters).

The floor area occupied by the unit is given by the following dryer dimensions:

Length	1800 mm	(3 ft. 11 ins.)
Width	925 mm	(3 ft. 1 in.)
Height	2200 mm	(7 ft. 1 in.)

The total weight is 620 pounds (280 kgs.).

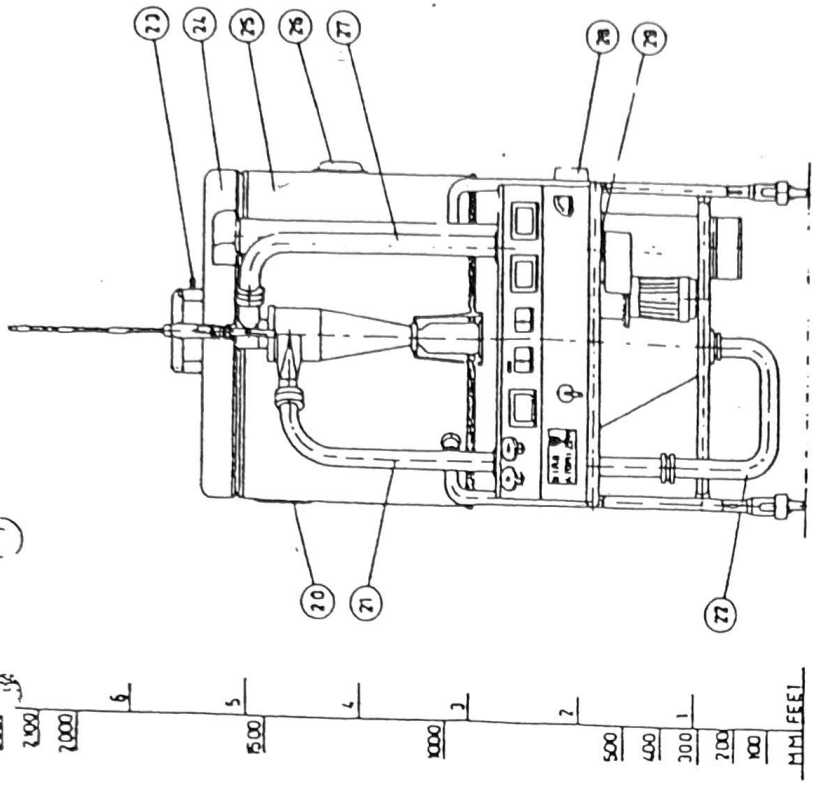
DESCRIPTION OF UNIT

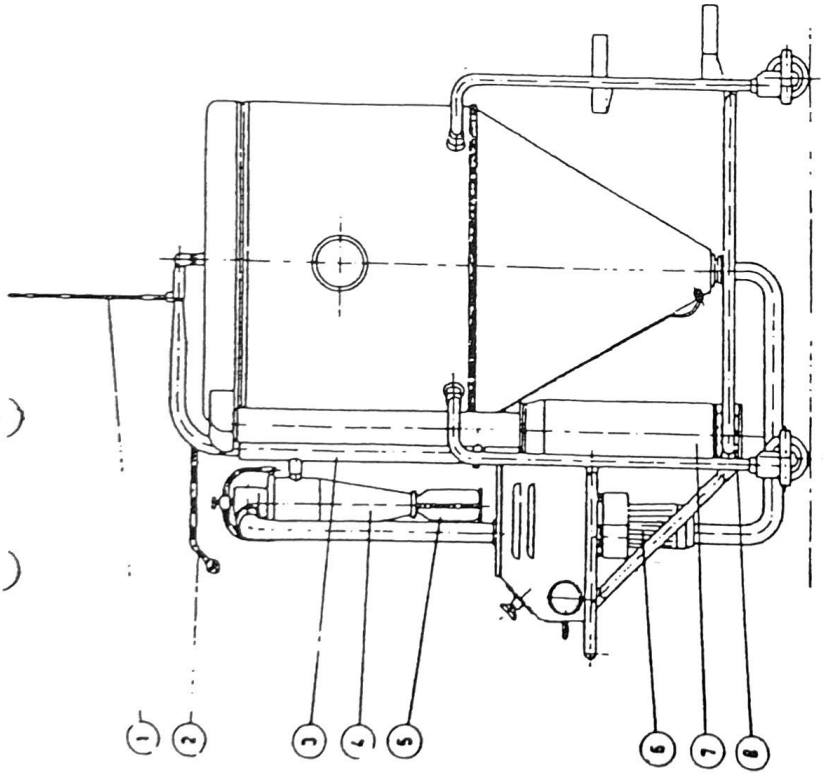
(With reference to Diagram No. ASO 340/D)
The unit consists of an insulated drying chamber (25) mounted rigidly within a framework. The framework also supports the auxiliary equipment, namely the instrument control panel (9) - (17), product recovery cyclone (4), air heater (7) and fan (28). The atomizer (19) is positioned within the drying chamber (25) and seated on a supporting ring within the chamber roof (24).

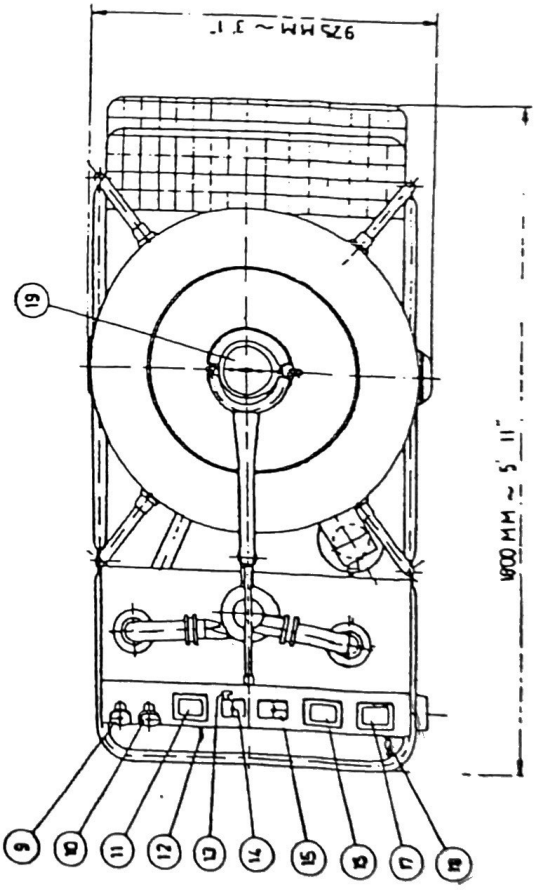
Air flow is drawn through the air filter (8), the air heater (7), and drying chamber (25) by a suction fan (28) installed on the exit side of the cyclone (4).

Feed liquid is fed to the atomizer (19) under gravity or by a small capacity pump, and atomized into a fine spray of droplets. The spray is contacted with hot air entering the chamber through a ceiling air disperser. The ceiling air disperser is positioned in the center of the chamber roof (24) and is designed to create a swirling air flow directly around the vaned atomizer wheel. Removal of moisture from the droplets is accomplished virtually instantaneously, and although residence time of product in the drying chamber (25) is short, dry powder is drawn off with the air at the base of the chamber. Powder and air pass to a small highly efficient cyclone (4) where the powder is separated out and collected in a glass jar (5). The glass jar can be exchanged during the drying operation.

All the necessary controls and instrumentation are centrally located on the panel. The air flow is controlled by the damper (18), situated at the right hand side of the instrument panel (near the exhaust fan air take-off (28)).







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A/S NIRO ATOMIZER

ARRANGEMENT
MOBILE MINOR SPRAY
DRYER

DRAWING NO. ASO 340/D

ITEM 2 — M.E. — C.C. — B.J. — T.N.

KEY TO ARRANGEMENT DRAWING NO. ASO 340/D

1. Vertical Support for Feed Container
2. Handle
3. Pneumatic Lifting Device
4. Cyclone
5. Powder Collecting Glass Jar
6. Fan Motor
7. Electrical Air Heater
8. Air Filter
9. Air Valve for Atomizer
10. Gas Valve for Gas Heater (if supplied)
11. Pressure Gauge
12. Valve for Lifting Device
13. Panel Live Control Lamp
14. Operation Switch
15. Percentage Timer
16. Thermometer for Inlet Air Temperature
17. Thermometer for Outlet Air Temperature
18. Damper for Exhaust Air
19. Atomizer
20. Chamber Window
21. Transport Duct
22. Transport Duct
23. Locking Device for Chamber Roof
24. Chamber Roof
25. Drying Chamber
26. Chamber Light
27. Transport Duct
28. Exhaust Fan Air Take-Off
29. Ball Bearing Housing for Fan

INSTALLATION OF THE UNIT

A. CONNECTION OF COMPRESSED AIR

Compressed air at 5 - 6 kg/cm^2 (70 - 90 lbs/sq.in.) is required to power (a) the atomizer (turbine drive type) and (b) the dryer roof, which is pneumatically lifted and lowered. During dryer operation, the compressed air capacity requirement approximates to 17 NM^3/h (10-12 scfm).

Compressed air is best supplied to the dryer via an air hose, which can be connected to the dryer by the air line coupling placed at the back of the instrument panel.

The air hose, for supplying air to the atomizer, is attached to the stud located at the back of the instrument panel.

It is important that air supplying the unit is free from water and oil. An oil/water separator must be placed in the compressed air line, as close to the unit connection as possible.

B. CONNECTION OF ELECTRIC SUPPLY

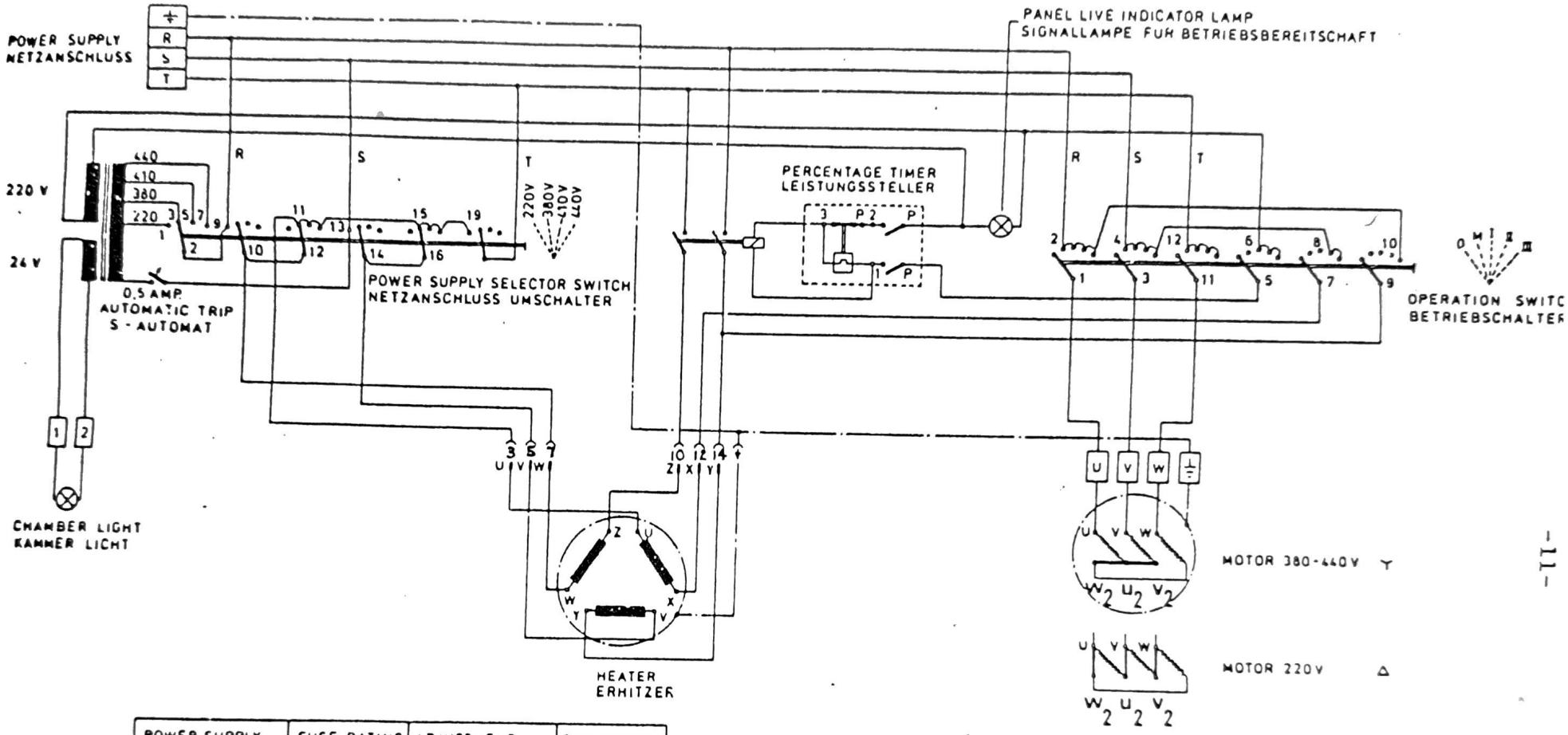
The cable connecting the power supply to the dryer is led through the screwed cable-entry fitting, at the back of the instrument panel. The cable is connected to the power supply terminal block. The power selector switch is then positioned, according ot the voltage of the power supply system. The unit must be suitably grounded. Internal wiring of the unit is completed, prior to dryer dispatch. Drawings regarding the connection of power to the terminal box and the motor connections for different voltages are given on the inside of the instrument panel

Connections to the motor should be checked. Rotation of the fan motor must be in a clockwise direction when viewed from the motor end.

The automatic trip switch (green) must be activated.

IMPORTANT

The power supply must be fitted with a fuse per the rating table on Page 21.



POWER SUPPLY	FUSE RATING	ADJUSTMENT POWER SUPPLY SELECTOR SWITCH	FAN MOTOR CONNECTION
NETZANSCHLUSS	SICHERUNG	EINSTELLUNG DES NETZANSCHLUSS-UMSCHALTERS	VENTILATOR-MOTOR SCHALTUNG
3 x 440 V	16 AMP.	440 V	Y
3 x 415 V	16 AMP.	410 V	Y
3 x 400 V	16 AMP.	380 V	Y
3 x 380 V	16 AMP.	380 V	Y
3 x 220 V	25 AMP.	220 V	Δ
3 x 200 V	25 AMP.	220 V	Δ

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NIRO ATOMIZER

ELECTRIC EQUIPMENT MAIN DIAGRAM

ELEKTRISCHE AUSRUSTUNG HAUPTDIAGRAM

2

280

FAO 1017/E

DRYER DETAILS

A. DRYING CHAMBER

The drying chamber is 800 mm in diameter, 600 mm cylindrical height and conical based. The cone angle is 60°. All internal surfaces that contact the product are stainless steel AISI 316. Air enters the chamber through the air disperser, placed in the chamber roof. Both air and product leave the base of the chamber through a 50 mm diameter duct, connecting chamber base to cyclone. The chamber is fully insulated so that heat loss is minimized.

Access into the chamber for cleaning is by lifting the chamber roof away from the chamber base. The lifting is easily carried out, using a built-in pneumatic system. The interior of the chamber can be reached by standing on the steps built onto the dryer framework. A window has been designed into the cylindrical section to enable observation of the atomization and drying process.

Care must be taken that the sealing gasket around the movable chamber top is never damaged.

B. ATOMIZER

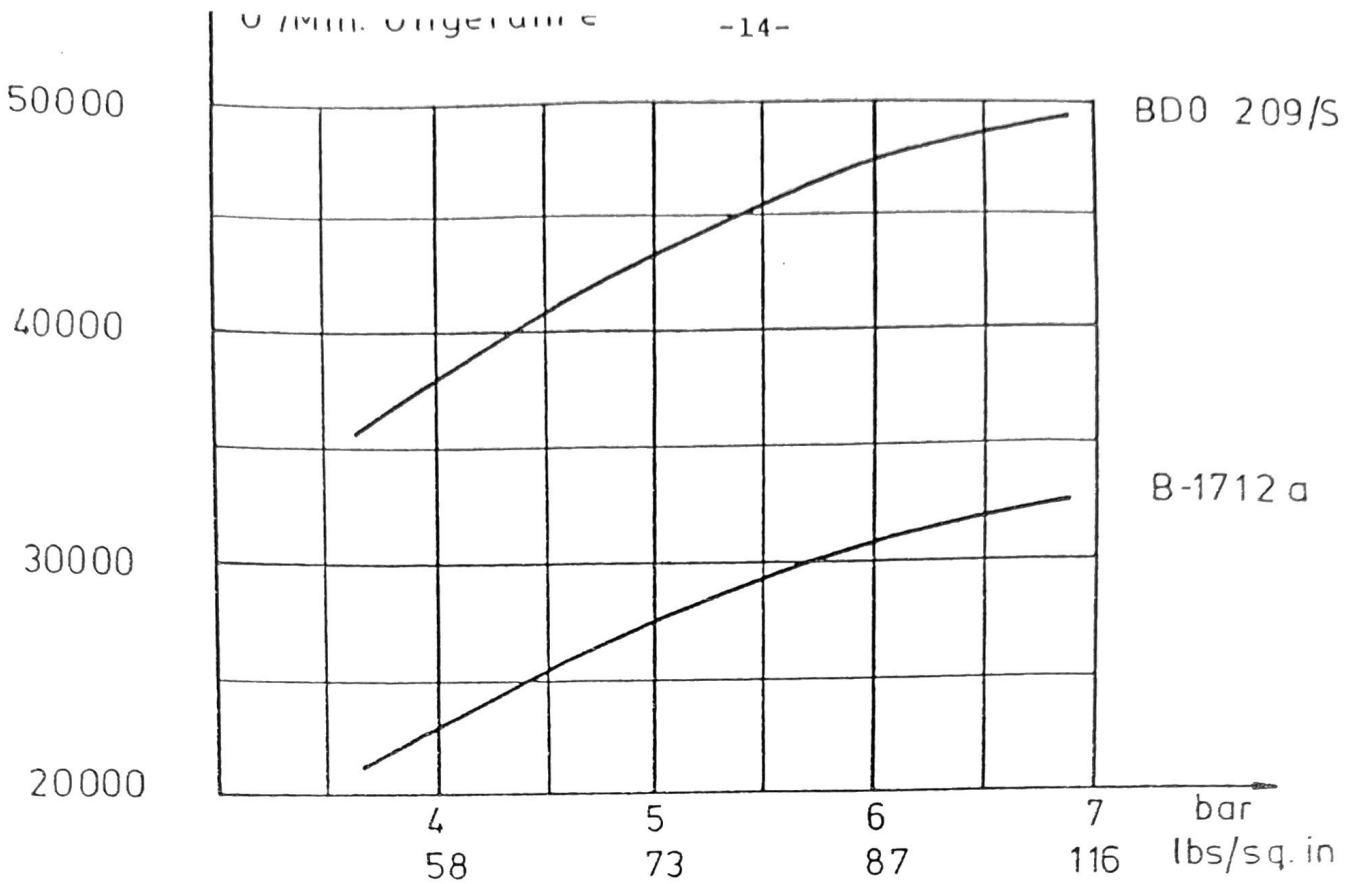
The atomizer is positioned within the drying chamber roof in a cylindrical recess. It rests on a rubber packing and should never be fastened. The compressed air hose (connected to the air line at the back of the instrument panel) is attached to the threaded hose connection on the atomizer.

NOTE: REMOVE THE RED PLASTIC CAP AT THE TOP OF THE ATOMIZER AND MOUNT THE BLUE SILENCER INSTEAD. THIS HAS TO BE DONE BEFORE COMPRESSED AIR IS SWITCHED ON.

DESCRIPTION AND INSTRUCTION FOR THE ATOMIZER

The atomizer design is shown in the enclosed drawing No. BAO 248/E. The vaned atomizer wheel is mounted on a high speed spindle driven by a compressed air turbine. The normal atomizer wheel supplied with the unit rotates within the range 25,000 to 32,000 r.p.m. If the speed is lower than specified, first check that the required air pressure is being applied to the atomizer. If the pressure gauge is found to show the correct pressure, the reduction in speed is due to abnormal friction. This occurs after much usage, and indicates that the bearings are badly worn or the spindle may have been damaged or bent. In either case, replacements must be fitted. If, on the other hand, the atomizer wheel rotates easily and nothing appears to be wrong with the bearings, wear of the turbine wheel might exist, or the turbine wheel not placed in correct alignment with the nozzles. Approximate speeds of the atomizer are indicated on the attached diagram. (BT2 003/B)

As shown in the enclosed drawing BA0248/E the atomizer has no extenal greasing nipples. The atomizer is supplied greased with special SKF grease and after approx. 100 hours' operation the atomizer will have to be taken apart, cleaned and the lubricant renewed. It is important that the bearings are greased only with the grease-type supplied in the atomizer box.



Type of atomizer wheel Typ des Zerstäuberrades	
BD0 209/S	4 inserts 4 Buchsen
B-1712 a	24 vanes 24 Schaufelungen

REVISED:

NIRO ATOMIZER
GLADSAXEVEJ 305
DK-2860 SØBORG
COPENHAGEN
TEL. 691011 TELEX 15603

This drawing is the property of N. A. It must not be used, copied or handed to any third party, or otherwise disposed of without our express permission in writing.

U/MIN. DIAGRAMM

ZENTRIFUGAL
RSTÄUBER
YP M-02/B

R.P.M. DIAGRAM

ROTARY ATOMIZER
TYPE M-02/B

SCALE			
~	Drawn by	BJ	0 BEB
	Cop. by	KTJ	0 BEB
00A	Check. by		
	Appr. by		

REPLACEM. FOR: BT2 002/B

BT2 003/B

INSTRUCTIONS FOR DISMANTLING AND ASSEMBLING OF THE ATOMIZER

Removal and Mounting of Atomizer Wheel and Liquid Distributor

The atomizer wheel and liquid distributor are frequently removed for cleaning. The procedure is as follows - referring to drawing No. BA0 248/E:

Loosen the nut (P) using the special tool placed in the atomizer box. The atomizer wheel can now be pulled off the shaft.

Unscrew the three screws (M) and pull the liquid distributor plate (Q) away from the atomizer body (K).

The mounting of the liquid distributor plate is straight forward, but the atomizer wheel must be located with the proper clearance between the wheel and the atomizer body. It is, therefore, recommended to use the distance fork, supplied in the box. This fork is placed between the wheel and the atomizer body, while the nut (P) is being fastened.

DISMANTLING THE SPINDLE AND BEARINGS FOR EXAMINATION

Remove the atomizer wheel, as described above.
Unscrew and remove the air pipe (G) and feed pipe (R).

Turn the atomizer upside down and remove the screws (A). The atomizer can then be easily dismantled into two parts by lifting the shell (H).

Remove the screws (Y) and fasten the carrying ring (D) in a vice, with the spindle end up. Place the enclosed fiber rods between the top plate (F) and the top part (T) (one on each side). Apply a light downward pressure and the "unit" consisting of shaft (L), turbine wheel (V/a) with nut (U/a), bearings (E) and (S),and the protection for the bearings (Z), can be removed from the top plate (F). The "unit" is now removed from the top part (T) by a sharp tap on the shaft end. Loosen the nut of the turbine wheel (U/a) and press the nut downwards. The "unit" then becomes accessible for inspection, cleaning and lubrication.

Use only chemically clean petrol for cleaning the bearings. The assembly of the atomizer is carried out in the reverse. It is important that the protections for the bearings are placed in their correct position.

1. The upper bearing protection:
   The shoulders in the plug (B) and in the turbine wheel (V/a) are filled with grease, whereupon the turbine wheel is pressed against the upper bearing (E) and fastened.

2. The lower bearing protection:
   The protection for the bearings (Z) is filled with grease and the "unit" is fitted in the top part (T), whereupon the protection for the bearing is pressed down into its correct position in the top part (T).

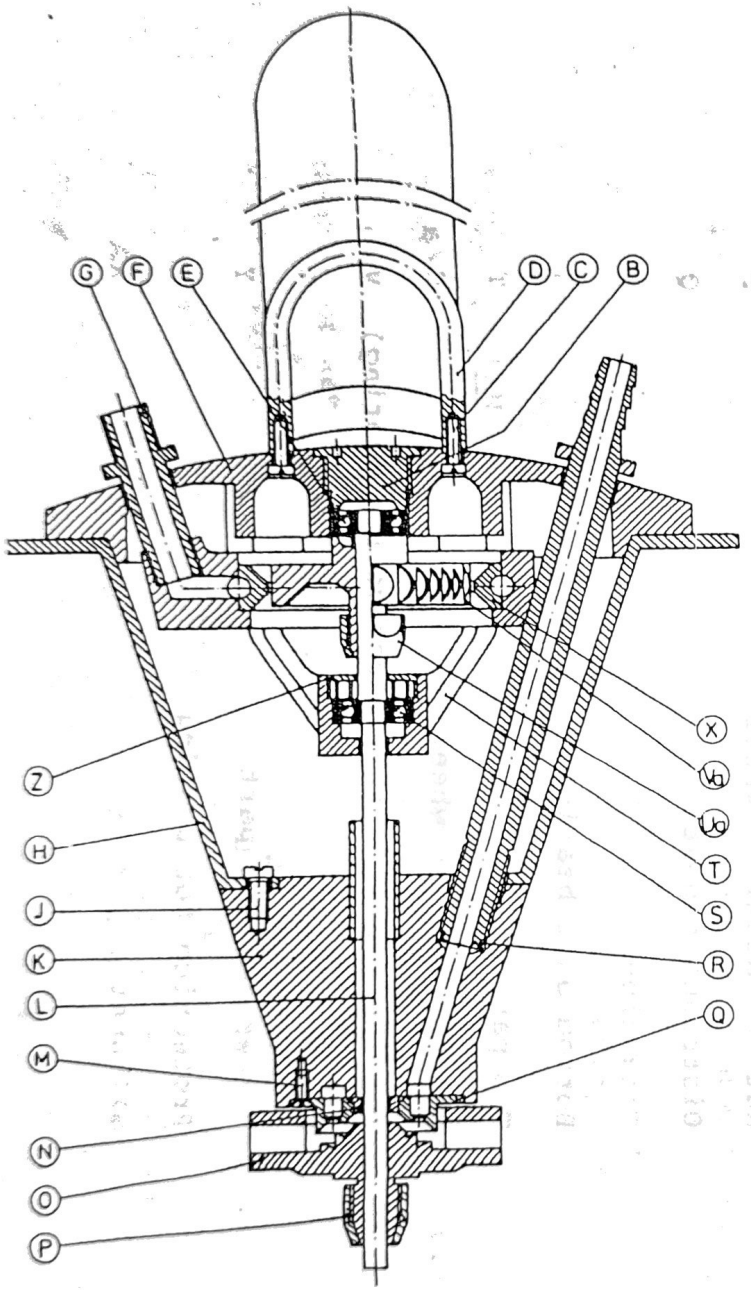
EXCHANGE OF BALL BEARINGS

Experience has shown that the mounting of ball bearings in this high speed atomizer demands mounting tools manufactured with great precision. It is not advisable that the customer, himself, carry out this mounting. NIRO ATOMIZER, in collaboration with SKF (Svenska Kullager Fabriken, Gothenburg, Sweden), has established a special workshop for dealing with the replacement of bearings.

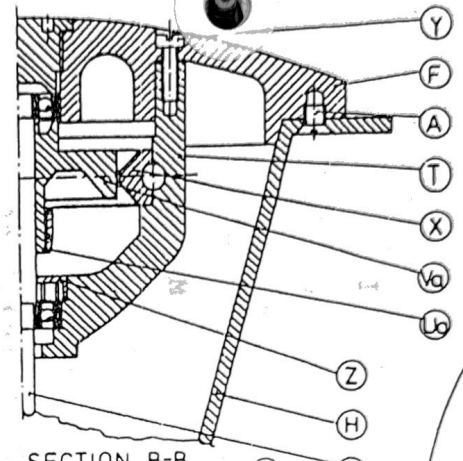
Therefore, an extra set of the atomizer moving parts is supplied in the atomizer box. This set consists of shaft, turbine wheel with nut, bearing and protection for bearing.

Should the bearing be worn, or the shaft bent, the extra "unit" can be mounted according to the above-mentioned instruction. The defective "unit" should be returned to NIRO ATOMIZER for exchange of bearings. The true running of the spindle and turbine is checked at the same time.

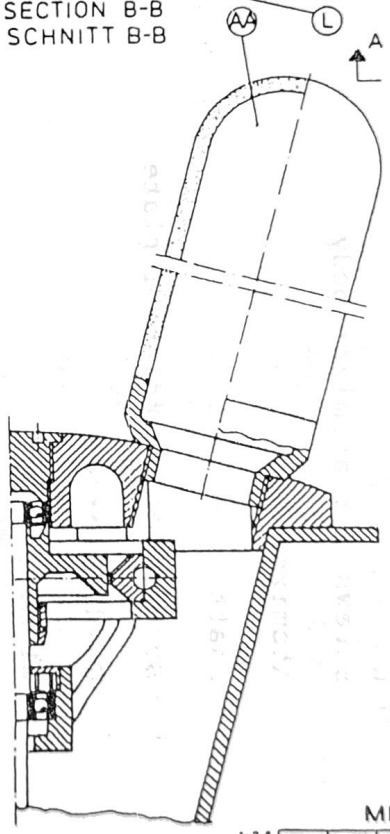
In cases of repair or complaint, please state the number engraved on the spindle.



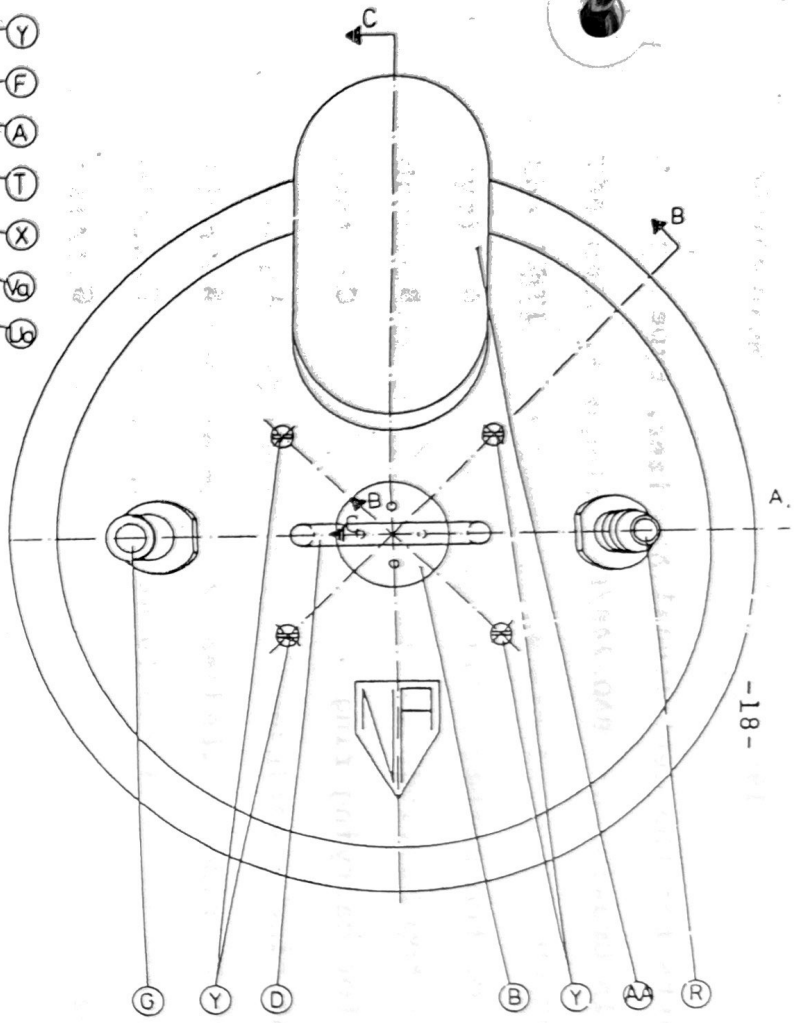
SECTION A-A
SCHNITT A-A



SECTION B-B
SCHNITT B-B



SECTION C-C
SCHNITT C-C



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CM 10 8 6 4 2 0 2 4 6 8 10 10 0 10 20 30 40 80
1:5 1:20
CM 10 0 10 20 30 40 0 20 40 60 80 100

NIRO ATOMIZER

ZENTRIFUGAL ZERSTÄUBER TYP M-02/B TRANSPORTABLE MINOR ANLAGE

ROTARY ATOMIZER TYPE M-02/B MOBILE MINOR UNIT

00A

BA0 248 E

Description of Parts for the Centrifugal Atomizer, type M-02/B, as shown in Drawing No. BAO 248/E:

NUMBER	DESCRIPTION	ITEM
4	Screws for top plate	A
1	Plug for top bearing	B
2	Screws for carrying ring	C
1	Carrying ring	D
1	Top ball bearing	E
1	Top plate	F
1	Air pipe	G
1	Shell	H
3	Screws for atomizer body	I
1	Atomizer body	K
1	Shaft	L
3	Screws for distributor plate	M
1	Guide bearing	N
1	Atomizer wheel	O
1	Nut for atomizer wheel	P
1	Distributor plate	Q
1	Feed pipe	R
1	Bottom ball bearing	S
1	Top part	T
1	Nut for turbine wheel	U/a
1	Turbine wheel (with protective for bearing)	V/a
1	Nozzle ring	X
4	Screws for top part	Y
1	Protection for bearing	Z
1	Silencer	AA

C. FAN

The unit is supplied with one fan, which is mounted under the instrument panel. The fan is on the exit side of the cyclone and, therefore, runs clean. The fan draws the drying air through the heater, air disperser, chamber and cyclone.

When putting the unit into operation, the direction of rotation of the fan must be checked. The fan must rotate in a clockwise direction when viewed from the belt end.

DETAILS OF FAN

Type	Centrifugal blower with backward curved vanes.
Amount of Air	Approximately 80 kg/h at 80°C
Number of Revolutions	4500 r.p.m.
Bearing	BAMAG (Double Bearing) Type 399 T 15 WD.
Lubrication	Greased for Life
V-Belt Pulley	50 mm diameter
V-Belt	FENNER 3190 High Modulus Rayon
Damper	Spring-Loaded Swivel Damper regulating the Amount of Air

MOTOR FOR FAN

Type	MT 63 B, 3-Phase Squirrel-Cage Motor
Number of Revolutions	2900 r.p.m.
V-Belt Pulley	90 mm diameter (80 mm diameter in case of 60 cycles)
Connection	(Delta) connection for 220V or under (Star) connection for 380V or over

D. ELECTRICAL SYSTEM, INCLUDING ELECTRIC AIR HEATER

The electrical system can be adjusted to any available 3-phase power supply.

The system is shown in Drawing No. FAO 1017/E and consists of:

Terminal Supply Selector Switch

Transformer

Operation Switch

Percentage Timer for Electric Heater

Automatic Trip

Electric Air Heater

Motor for Fan

The connection of the electrical power supply system is described in the section headed INSTALLATION. The necessary fuses for the system are given in the following table.

3-Phase Power Supply	Fuse Rating	Adjustment Power Supply Selector Switch	Fan Motor Connection
440 V	16 A	440 V	Star
415 V	16 A	410 V	Star
400 V	16 A	380 V	Star
380 V	16 A	380 V	Star
220 V	25 A	220 V	Delta
200 V	25 A	220 V	Delta

ELECTRICAL COMPONENT DETAILS

The Automatic Trip

This is one pole safety device, with magnetic-thermal cut-out. It protects the transformer system against continuous overload and against short circuiting.

Effect of Operation Switch and Percentage Timer on Heater Output

The various positions of the operation switch correspond to the plant's component switches. Turning the operation switch to the following positions activate the following:

Position O - Chamber light and panel live indicator light

M - Fan Motor

I - One element is activated on the percentage timer circuit. Approximately 2.5 kW is available. The power can be varied continuously using the percentage timer.

II - Two-thirds capacity is available. Approximately 5 kW. 2.5 kW power is permanently supplied to one element. Another 2.5 kW can be regulated by the percentage timer.

III - At full capacity approximately 7.5 kW is available. 4 kW power is permanently supplied to two elements. The remaining 2.5 kW available can be regulated by the percentage timer.

The percentage timer is graduated from 0-10. Increasing the setting increases the percentage of time the adjustable element is on and, therefore, the amount of heat available.

The position selected depends upon the inlet drying air temperature required for the drying operation.

TEMPERATURE	POSITION	
Up to 125°C (257°F)	I	(0 - 2.5 kW)
Between 125° - 200°C (257° - 392°F)	II	(2.5 - 5 kW)
Over 200°C (392°F)	III	(5 - 7.5 kW)

IMPORTANT

The electric heater must only be switched on when AIR IS FLOWING through the dryer. As the fan draws air through the heater, it is important that the dryer is fully assembled to obtain the correct air flow. That is, the dryer roof must be shut, the atomizer is positioned in the dryer, all the ducts are fastened with their gaskets, and the glass collecting jar is fitted to the cyclone base.

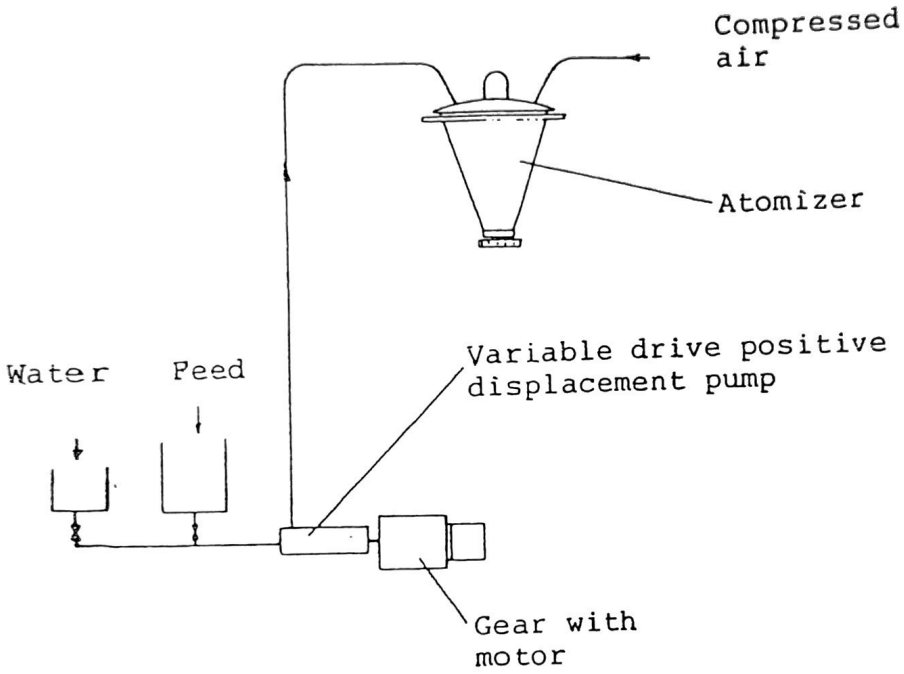
E. FEED ARRANGEMENT

There are normally two alternatives of feed arrangement for the Portable unit.

(a) Pumping the feed liquid to the atomizer

(b) Feeding the atomizer with liquid by gravity.

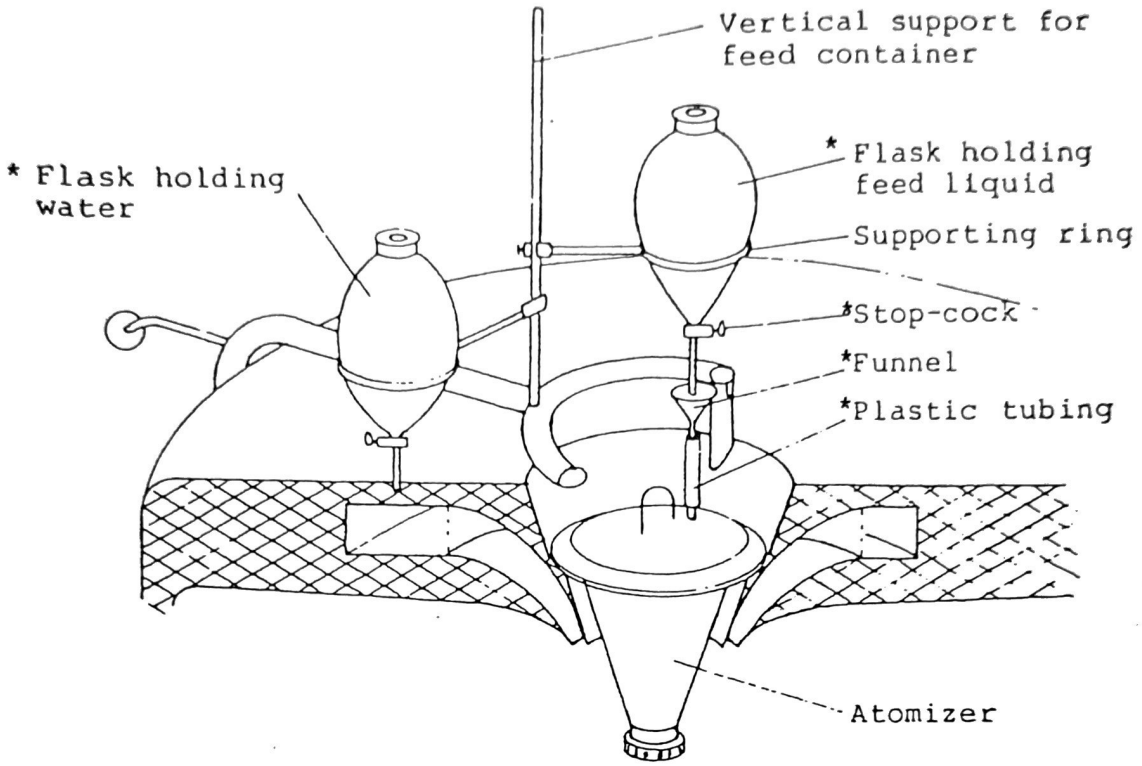
1. The feed arrangement is shown in the diagram below:



Feed rates to the dryer are small, and only a small positive displacement pump is required. The pump must be fitted with a variable speed drive. A plastic tube connects the pump to the atomizer. It is advisable to use two small tanks, one for water and one for the feed liquid. The water tank is required during dryer start-up and shut-down. (See Section OPERATIONAL PROCEDURE).

2. The feed arrangement is shown in the diagram below:

*Supplied by Customer



The atomizer feed tube is extended upwards, using a length of plastic tubing. A small funnel is placed in the open tubing end. The feed container, which can be a separating flask (complete with stop-cock), is clamped above the funnel or supported in a ring, as shown on the diagram. The liquid flow into the funnel is regulated manually for the stop-cock A second separating flask is required to hold water. At the beginning and end of the dryer operation, this water flask is swung over the funnel to permit water flow into the atomizer.

OPERATION PROCEDURES

A. PRIOR TO START-UP

B. START-UP

C. DRYER CONTROL

D. SHUT DOWN

E. CLEANING

(Item numbers refer to Diagram No. ASO 340/D)

A. PRIOR TO START-UP

Prior to start-up, the following must be checked:

1. The liquid distributor and the atomizer wheel must be correctly mounted, having the specified distance between them. Check that the vaned wheel freely rotates.

2. Check that the oil level in the feed pump variable drive gear box is correct (if supplied).

3. Check all duct connections for tightness. All gaskets must be correctly mounted. No false air must be sucked into the dryer system, due to air leakage around the duct connections.

4. Check that the glass jar under the cyclone is securely fastened. The glass jar must be clean and dry. It is recommended to preheat (warm) the glass jar to prevent condensation occurring in the jar during the early stages of the drying.

B. START-UP

With power switched on to the unit, the chamber light (26) and the panel live indicator lamp (13) will light up. Turn the operation switch (14) from 0 to M position and the fan will start. Turn the switch to I, II or III, depending on the inlet air temperature required. Use the percentage timer (15) to adjust the air temperature until the desired inlet air temperature is obtained.

With the heater on, and the fan started, start the atomizer by completely opening the yellow valve on the instrument panel. The atomizer will accelerate rapidly with a squealing sound, which gradually decreases until it becomes almost inaudible at full speed (pressure of 6 kg/cm^2). The air pressure is indicated on the pressure gauge and this must be kept constant. The atomizer will, of course, lose speed if the pressure decreases. It is essential that the speed is kept constant in order to obtain an efficient liquid atomization.

The atomizer will reach top speed after 30 seconds then pass distilled water to the atomizer, until the required outlet air temperature is obtained. (The outlet temperature depends on the product to be dried. For many products about 85°C (185°F) will be suitable.

When the outlet temperature has been obtained and is maintained constant, switch from the water supply to the liquid feed. The drying operation now commences.

NOTE:

The unit is designed to operate with an inlet air temperature of MAXIMUM 350°C (662°F) and an outlet air temperature of MAXIMUM 150°C (302°F).

C. DRYER CONTROL

The drying operation is controlled by maintenance of the required outlet air temperature at a constant inlet temperature. For a given feed liquid of constant physical properties, the outlet air temperature is related directly to the moisture content of the dried powder. Increase in outlet temperature reduces the moisture content; decreasing the temperature increases the moisture content. Once the outlet temperature range, to obtain dried product from the drying chamber, has been established, the outlet temperature can be precisely adjusted to obtain the required moisture content. During the drying operation, it is most important to keep the outlet air temperature constant, so as to maintain the moisture content level.

This is carried out by regulating the rate of feed. Usually, the outlet air temperature does not change, once the feed rate has been adjusted. Alterations of the viscosity and the solids content of the product will influence the outlet air temperature.

If the feed rate is too large, it is likely that the powder, already in the chamber, will absorb moisture and stick to the chamber wall.

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Until the operator has made ~~him~~themself quite familiar with the unit, any variation in the amount of feed must be carried out in small increments. Adjustment must take place very slowly, stepwise, and with intervals of sufficient length to enable the resulting effects to be registered on the thermometer.

The powder is collected in the glass jar, mounted under the cyclone. It is important that the glass jar is exchanged before it becomes completely full. A full glass jar results in high product losses from the cyclone.

When drying hygroscopic products, warm the glass jar before drying. It may also be necessary to insulate the cylone and the air duct, in order to avoid condensation.

Products, that are difficult to dry, must be atomized at the highest possible speed of the vaned wheel. A low speed will give a coarser droplet size, but may result in wet wall deposits. A high speed gives fine droplets, which are retained in the chamber air flow and, thus, dried before reaching the chamber wall.

D. DRYER SHUT-DOWN

Before the unit is shut down, a change-over of feed from product to distilled water must take place. The amount of water fed to the atomizer must be regulated, so that the outlet air temperature does not decrease. This is most important, as the powder in the drying chamber will absorb excess moisture.

The unit is to run 5 to 10 minutes with water, in order to flush clean the atomizer wheel and the feed pipe. The air heater is then switched off. After setting the percentage time at 0, and the operation switch at M, the water supply is turned off. Approximately 3 minutes later, the atomizer is stopped.

Draw cold air through the dryer for 5 minutes or so. When the outlet air temperature is approximately 50°C (122°F), the chamber is opened by means of the pneumatic lifting device. If powder is retained in the chamber, it can be swept down. Switch the fan on during this operation.

Finally, turn the operation switch to position O, which cuts the power supply.

NOTE

If it is necessary to stop the spray dryer suddenly, it is most important that the feed rate is stopped IMMEDIATELY.

E. CLEANING

The atomizer wheel and the liquid distributor must be removed from the atomizer and cleaned immediately after the operation. Keep the atomizer in its box when not in use.

For dry cleaning, lift the chamber roof and turn it vertically upwards. When the roof is in the upright position, insert the locking pin. This is a safety precaution. Brush down the powder from the chamber walls and roof. Leave the fan running. All powder will be collected in the glass jar, under the cyclone. Hygroscopic powders must always be swept down immediately.

For wet cleaning, the fan must be stopped and the electrical power supply switched off. Disconnect the duct at the chamber base. However, the ducts can be used to guide the waste water towards the drain. Hose down the interior of the chamber.

It is best to dismantle the ducts and cyclone for thorough cleaning.

Never spray water onto the instrument panel, or the light fixture.

For cleaning, synthetic washing powders, industrial cleaners, and soap solutions are recommended as cleaning media. Rinsing with water takes place after their use.

Following cleaning, the spray dryer must be assembled correctly. All connections must be tight and all parts dry. Drying out of the dryer must be done by drawing hot air through the unit for some time before start-up.

NOTE:

It is recommended that regular inspection and cleaning of the fan is carried out. Deposits on the impeller of the fan may cause vibrations and may cause irregularity in the spray dryer operation.

DESCRIPTION	PART NO.
ATOMIZER	
Atomizer with wheel and nut	13591-0001
Normal atomizer wheel with nut	10084-0001
Abrasion resistant atomizer wheel with nut	11624-0001
Spindle unit, complete, consisting of: Spindle, 2 ball bearings, driving wheel with nut, protection for bearing, 5-5-5	10195-0001
Ball bearing	14041-0009
Spindle 5-5-5	10194-0001
Liquid distributor with guide bearing	10434-0002
Silencer	13281-0001
INSTRUMENT PANEL	
Thermometer - Inlet - 100 to 400°C	15654-0001
Thermometer - Outlet 0 to 150°C	15653-0001
Pressure gauge = 0 to 10 Kg/cm^2	15655-0001
Operation Switch	15656-0001
Percentage timer	15657-0001
Automatic trip	15658-0001
Control lamp	15659-0001
Relay	15660-0001
Transformer	15661-0001
Terminal selector supply switch	10067-0001
Valve for lifting device - Atlas Copco	15662-0001

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FAN

Fan only, without motor	15665-0001
Ball bearings unit for fan	15666-0001
Motor for fan, 220/380V, 250/440V	15663-0001
V-belt for fan	15687-0001
Sleeve, fan suction side	10006-0001

GASKETS

x Rubber gasket for 2" union	13397-0051
x Silicon gasket for chamber cover	15584-0001
x Rubber gasket for cyclone glass jar	10176-0001
x Silicon gasket for atomizer	13788-0001
x Set of rubber gaskets for lifting device for chamber cover	13214-0001

SUNDRIES

Heating element, 440 V - 2.5 KW	15674-0001
Heating element, 380 - 415 V - 2.5 KW	15675-0001
Glass for light source sandblasted	15676-0002
Glass for observation window clear	15676-0001
x Lamp for light source - 25 W, 24V	15677-0001
Prefilter for air heater	15678-0001
Powder collection glass jar	13455-0001

x These parts are not covered by our guarantee as it is a question of normal wear.

Delivery can normally be effected from stock.